**Linux for S/390 - It’s cool**

**Part 1**

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**Agenda - Part 1**

- Background
- Attributes
- Why Linux on S/390 ?
- System Structure
- System Requirements
- Platform Support
- Middleware / Applications / Tools
- Summary
- Linux for S/390 on the Web
Background

What is Linux?

- A popular UNIX system, developed by Linus Torvalds in 1991
- Portable, with support for numerous hardware platforms
- Available in source code, under GNU General Public License (GNU GPL)
- A very stable operating system, developed and tested by 1000s of programmers world wide
- Fast reaction to market requirements
- Lots of different distributions, like Red Hat, SuSE, Caldera, Turbo Linux, Debian, and many others

More facts about Linux...

- The number of Linux users grew from about 1,000 in 1992 to about 9 million last year, according to the Tower Group.
- Linux is the fastest growing server operating system, growing at 166% last year, according to IDC.
- Netcraft estimates 58% of Web Servers Run Open Source Operating Systems
- IBM supports the Linux Platform in response to customer demand
Linux for S/390

The project was initiated by a small development team in the IBM development laboratory in Böblingen/Germany.

Open source in the internet 12/1999 under GNU GPL
- first refresh 02/2000
- second refresh 05/2000
- permanent support for the open source community

The source packages adapted to S/390 includes:
- kernel 2.2.13 (12/99) / 2.2.14 (2/00) / 2.2.15 (5/00)
- gcc 2.95.1 (12/99) / 2.95.2 (5/00)
- gdb 4.18
- binutils 2.9.1
- glibc 2.12
- strace 3.1.0.1

Early users contributing press articles on Linux for S/390
- Scott Courtney - LinuxToday - "S/390: The Linux Dream Machine"
**Base Assumptions**

- Linux is Linux
  - only adaptations required to match S/390 architecture
  - no modifications at the common code
  - Linux system structure remains untouched

- S/390 is S/390
  - no adaptation layer required to run Linux
  - the S/390 architecture is sufficient to run Linux

**Combine the strengths of Linux and S/390**

**don’t try to reinvent a S/390 specific Linux**

**Proof of Concept**

- More than 400 Linux packages have been "ported"
  - Apache, Samba, Xlib, Gimp, Gnome, Regina (REXX), THE (Xedit),
    (X)Emacs, Perl, OpenLDAP, OpenSSL, IMAP, Sendmail, Bind, Bochs,
    and many others more ...

**Usually the porting "effort" was just a recompile only !**
Linux for S/390 Attributes

- Linux for S/390 is a true Linux port
  - No API emulation layer on OS/390
  - Fully ASCII based
  - IEEE floating point support
- Runs on CMOS processors G2 or more recent
  - P/390, R/390
  - Integrated Server
  - Multiprise 2000 / 3000
  - 9672 Rx2 +

Linux for S/390 Attributes (cont.)

- S/390 system environments
  - VM guest
  - Logical Partition (LPAR)
  - Native
- IPL / boot support
  - VM reader
  - Tape, including emulated tapes (Optical Media Attach)
  - Disk (ECKD)
  - HMC/SE CD-ROM IPL support * new * with MCL upgrade
Attributes (cont.)

- Multiprocessing support
  - Hardware: 12 way
  - VM guest: 32 way

Why Linux on S/390

- Applications
  - Large selection
  - Rapid deployment
- Skills
  - Large numbers of highly skilled programmers familiar with Linux
  - Strong interest in colleges and universities
- Vendor enthusiasm
  - Major ISV / USV efforts for Linux
- Implementor enthusiasm
  - Emerging interest in large datacenters
Why Linux on S/390  

- **Reliability**
  - The most reliable hardware platform available. Period.
  - Over 35 years of constant improvements
- **Scalability**
  - 15 Linux images possible on native hardware
  - Virtually unlimited Linux images possible with VM/ESA
- **Manageability**
  - Centralized Linux systems easier to manage / duplicate
  - Use management functions from S/390 operating systems for Linux (e.g. backup, autostart, etc.)
  - Simplified management - One server versus many

Linux Scenarios

- Single application per server
- Separate/partitioned data bases
- Complex system management
- Complex to integrate applications
- Support for diverse work loads
- Multiple applications per server
- Databases shared with integrity
- Less complex system management
- Interoperability and integration between applications
**Linux Scenarios**

**Linux for S/390**

- **S/390 Qualities of Service**
  - Leverage S/390 Technology
  - Low latency networking to Backend Transaction Data
- **Reduce Total Cost of Computing**
  - Large Horizontal growth through Virtual Servers
  - Low Administration and Management Overhead
  - Flexible, Fast Server Deployment

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**Linux Scenarios**

**Linux for S/390**

- **Linux server consolidation**
System Structure

Linux for S/390

Linux applications

GNU compiler

GNU binutils

GNU C runtime library

Linux kernel including some device drivers

IBM contributed

architecture independant

non-IBM contributed

architecture dependant

IBM contributed

Linux - modular and highly portable

### System Structure

**Example for network support**

<table>
<thead>
<tr>
<th>TCP/IP</th>
<th>Common Linux</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td>Linux for S/390</td>
</tr>
<tr>
<td>Token Ring</td>
<td>architecture specific code</td>
</tr>
<tr>
<td>LCS Device Driver</td>
<td>S/390 Hardware</td>
</tr>
</tbody>
</table>

#### do_IRQ (CCW Chain)
Int_Handler (device status block)

#### Common I/O Support Routines
- SSCH
- I/O Interrupts

### Device Support

<table>
<thead>
<tr>
<th>Linux for S/390</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Common I/O Support</td>
</tr>
<tr>
<td>- Allow for 64k subchannels</td>
</tr>
<tr>
<td>- Dynamic device attach / detach</td>
</tr>
<tr>
<td>- System Console Support</td>
</tr>
<tr>
<td>- Integrated Console at the Support Element (SE)</td>
</tr>
<tr>
<td>- Hardware Management Console (HMC)</td>
</tr>
<tr>
<td>- 3215 line mode (VM, P/390, R/390, IS/390)</td>
</tr>
<tr>
<td>- Disk Support</td>
</tr>
<tr>
<td>- ECKD (3990/3390, 3990/3380, 9345, ...)</td>
</tr>
<tr>
<td>- Reserved VM Minidisks (CKD, ECKD, FBA)</td>
</tr>
</tbody>
</table>
Device Support

- **Network Support**
  - Ethernet, Token Ring, Fast Ethernet (FE), ATM LAN Emulation (ATM LE)
  - IUCV (VM)
  - ESCON, and parallel CTCA (incl. VCTCA - VM)
  - OSA-2 (EnTr, FE, ATM LE)
  - LAN Channel Station (LCS) protocol
  - OSA Express Fast Ethernet (LCS)
  - 3172 - real, emulated (LCS)
  - IBM 2216 Router (LCS - ESCON connected)

- **Tape Support**
  - 3480/3490 (in development)

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System Requirements

- **Processor Requirements**
  - 9672 Rx2 - Rx7
  - Multiprise 2000 / 3000
  - Integrated Server
  - P/390, R/390

- **Memory Requirements**
  - 64 MB+

- **Disk Space Requirements**
  - 500 Cyl + (3390)
Where to get ...

- **Marist College**
  - limited contents "distribution" based on the Linux for S/390 source deltas with about 100+ packages compiled.

- **SuSE**
  - SuSE announced to release a Linux for S/390 distribution in 2H2000

- **TurboLinux**
  - TurboLinux announced to release a Linux for S/390 distribution in 2H2000

Software ...

- **IBM**
  - **Product / Package**
  - **Availability**
    - DB2 Connect / DB2 UDB
      - Beta 3Q00 / Avail. 4Q00
    - IMS Connect
      - Beta 3Q00 / Avail. 4Q00
    - Websphere 3.5 on JVM 1.2.2
      - Beta 3Q00 / Avail. 4Q00
    - MQSeries
      - Beta 3Q00 / Avail. 4Q00
    - CICS Transaction Gateway
      - Beta 3Q00 / Avail. 4Q00

- **Software AG**
  - Tamino XML Information Server

- **BMC**
  - BMC Patrol
Support ...

- IBM Global Services will offer ...
  - Consulting and planning services
  - Implementation services
  - Infrastructure design
  - Application enablement services
  - Database enablement services
  - Defect and remote technical support for SuSE and TurboLinux distributions

Linux Strategy ...

- S/390 is pursuing ...
  - Evaluation of Linux marketplace - especially high end servers
  - Using S/390 Linux to complement S/390 Operating Systems and leverage enterprise data
  - S/390 hardware value for Linux environments

- S/390 is not pursuing ...
  - A unique version of Linux
  - A Linux personality on another operating system
  - Replacing an existing operating system with Linux for S/390
Summary ... Linux for S/390

- Linux for S/390 is no replacement for existing S/390 operating system environments
  - Complementary system environment
  - Exploit S/390 'Quality of Service' for UNIX style customer applications
  - Brings Linux product portfolio to S/390
  - A single, common development / run-time environment: develop anywhere what you want to run on the host

Summary ... Linux for S/390

- Linux for S/390 is no replacement for existing S/390 operating system environments (cont.)
  - Allows for heterogenous software solutions on single hardware platform
    - Allows for powerful connection of traditional S/390 applications to Linux/UNIX type applications
    - Allows for integrated Linux-OS/390, or Linux-VSE software solutions
Internet Web sites  Linux for S/390

- IBM S/390 Linux Website

- IBM developerWorks website with Linux for S/390 modifications

- Marist College Linux for S/390 Download site
  - http://linux390.marist.edu

- Princeton University Linux for S/390 site - compiled tools / applications
  - http://penguinvm.princeton.edu/

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Millenux Linux for S/390 site - over 400 compiled tools and applications
- http://linux.s390.org

Marist College Linux for S/390 discussion group
- Listserv@vm.marist.edu
- send note with body SUBSCRIBE LINUX-390 your name